

SHANNON & WILSON, INC.

APPENDIX D

GEOTECHNICAL LABORATORY TEST RESULTS

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APPENDIX D

GEOTECHNICAL LABORATORY TEST RESULTS

D.1 INTRODUCTION

This appendix contains descriptions of the procedures and results of laboratory tests performed on the soil samples obtained from the borings accomplished for the Greenwood Subsurface Characterization Study. The samples were tested to determine basic index properties.

Geotechnical laboratory testing included water content determinations, Atterberg Limits, grain size distribution tests, organic content determinations, and peat classifications. Laboratory testing was performed in general accordance with the American Society for Testing and Materials (ASTM) standard test procedures at the Shannon & Wilson, Inc. laboratory in Seattle, Washington.

D.2 WATER CONTENT DETERMINATIONS

The natural water content of all the soil samples recovered from the borings was determined in general accordance with ASTM D 2216, Standard Method of Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil-Aggregate Mixtures. Comparison of natural water content of a soil with its index properties can be useful in estimating soil unit weight, consistency, compressibility, and strength. Water contents are plotted on the boring logs presented in Appendix B.

D.3 ORGANIC CONTENT DETERMINATIONS

The organic (or ash) content of 8 samples was determined in accordance with ASTM Designation: D 2974, Standard Methods for Moisture, Ash and Organic Matter of Peat and other Organic Soils. The organic contents are presented in Table D-1.

D.4 GRAIN SIZE ANALYSES

Grain size analyses were performed on nine selected samples in general accordance with ASTM D 422, Standard Method for Particle-Size Analysis of Soils. The general procedures used to determine the grain-size distribution of the soil samples was sieve analyses.

Grain size distribution is used to assist in classifying soil sand to provide correlation with soil properties, including permeability, capillarity, and sensitivity to moisture. Results of the grain-size analyses are plotted on the grain-size distribution curves presented on Figures D-1 and D-2. The figures also summarize the sample description, including the Unified Soil Classification System (USCS) symbol for the soil group, percentage of fines passing the No. 200 sieve, and natural water content.

D.5 ATTERBERG LIMITS DETERMINATIONS

Atterberg Limits were determined on five selected samples of fine-grained soil obtained from the borings in general accordance with ASTM D 4318, Standard Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils. The Atterberg Limit include Liquid Limit (LL), Plastic Limit (PL), and Plasticity Index ($PI = LL - PL$). They are generally used to assist in classification of soils, to evaluate soil consistency (when compared with natural water content), and to provide correlation to soil properties including compressibility and strength. The results of the Atterberg limits determinations are presented on Figure D-3, and graphically on the boring logs in Appendix B.

D.6 PEAT CLASSIFICATION

Peat classification/descriptions were determined for four selected samples. The classifications were based on MacFarlane (1969) and are summarized in Table D-2.

D.7 REFERENCES

American Society for Testing and Materials (ASTM), 2003, Annual book of ASTM standards: Soil and rock, building stone; geosynthetics: Philadelphia, Pa., American Society for Testing and Materials, v. 04.08.

MacFarlane, I.C., 1969, Muskeg Engineering Handbook, University of Toronto Press, Toronto, Canada.

TABLE D-1
SUMMARY OF ORGANIC CONTENT

Boring	Sample No.	Depth (feet)	Organic Content (%)
GB-1	1	2.5	36.5
GB-2	2	5	79.6
GB-3	4	10	34
GB-4	2	5	38.5
GB-5	2	5	85.5
GB-6	3	7.5	26.5
GB-7	1	2.5	54.9
GB-8	2A	5.5	11.4

TABLE D-2
PEAT CLASSIFICATION

Boring and Sample ID	Depth in Feet Below Ground Surface	Description
GB-3, S-3	7.5 to 9.0	Category 3/8 – Amorphous-granular peat/non-woody fine fibers (and trace of long, non-woody, coarse fibers, oriented vertically)
GB-3, S-4	10.0 to 11.5	Category 3 – Amorphous-granular peat containing non-woody fine fibers (alternating with amorphous-granular peat [organic silt])
GB-5, S-2	5.0 to 6.5	Category 13 – Coarse, long fibers criss-crossing fine fibrous peat (containing amorphous-granular peat)
GB-6, S-2	5.0 to 6.5	Category 13 – Coarse, long fibers criss-crossing fine fibrous peat. Fibers 2 to 3 mm ϕ (containing amorphous-granular peat)

Note: Description based on (MacFarlane, 1969).

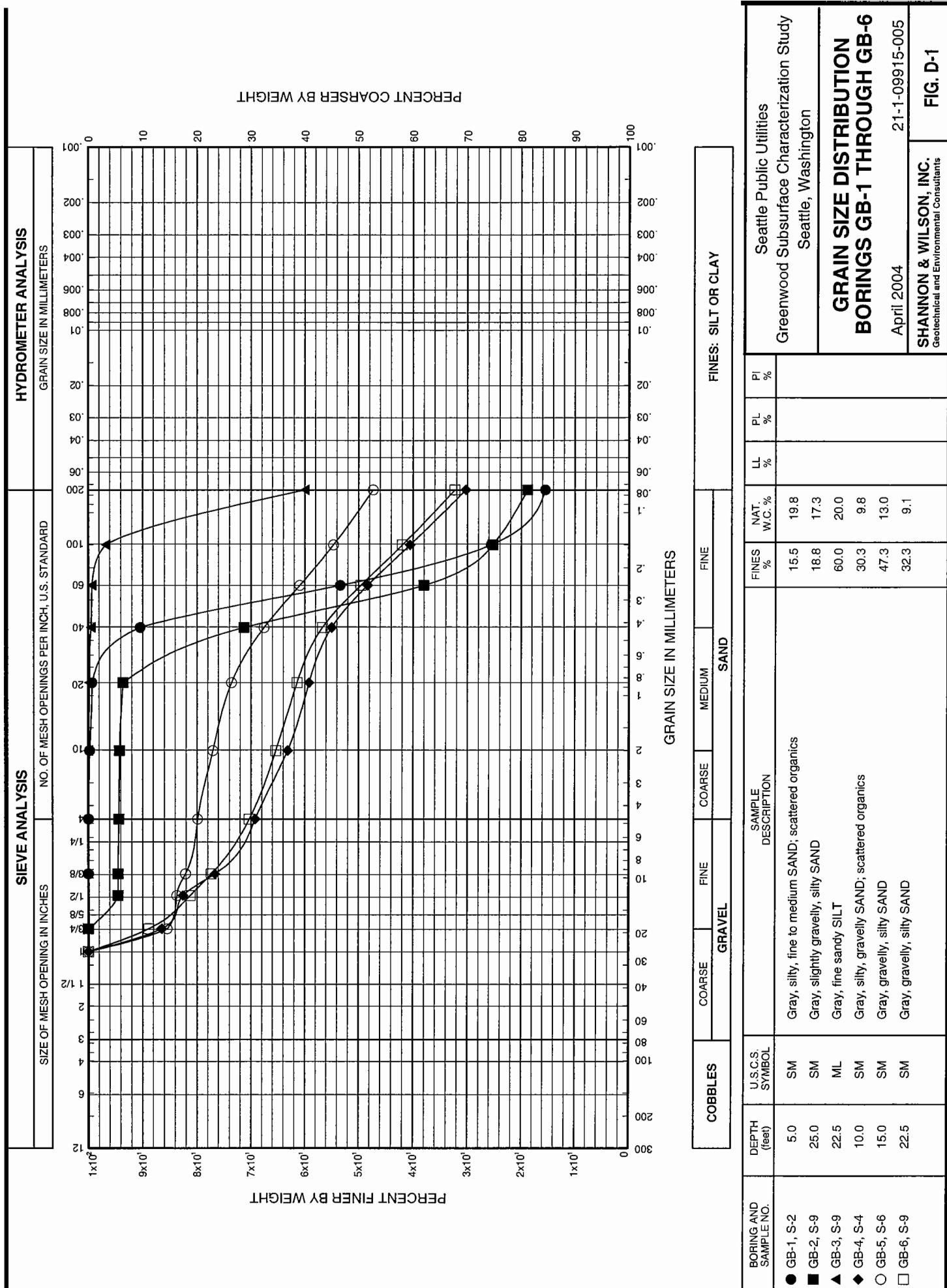


FIG. D-1

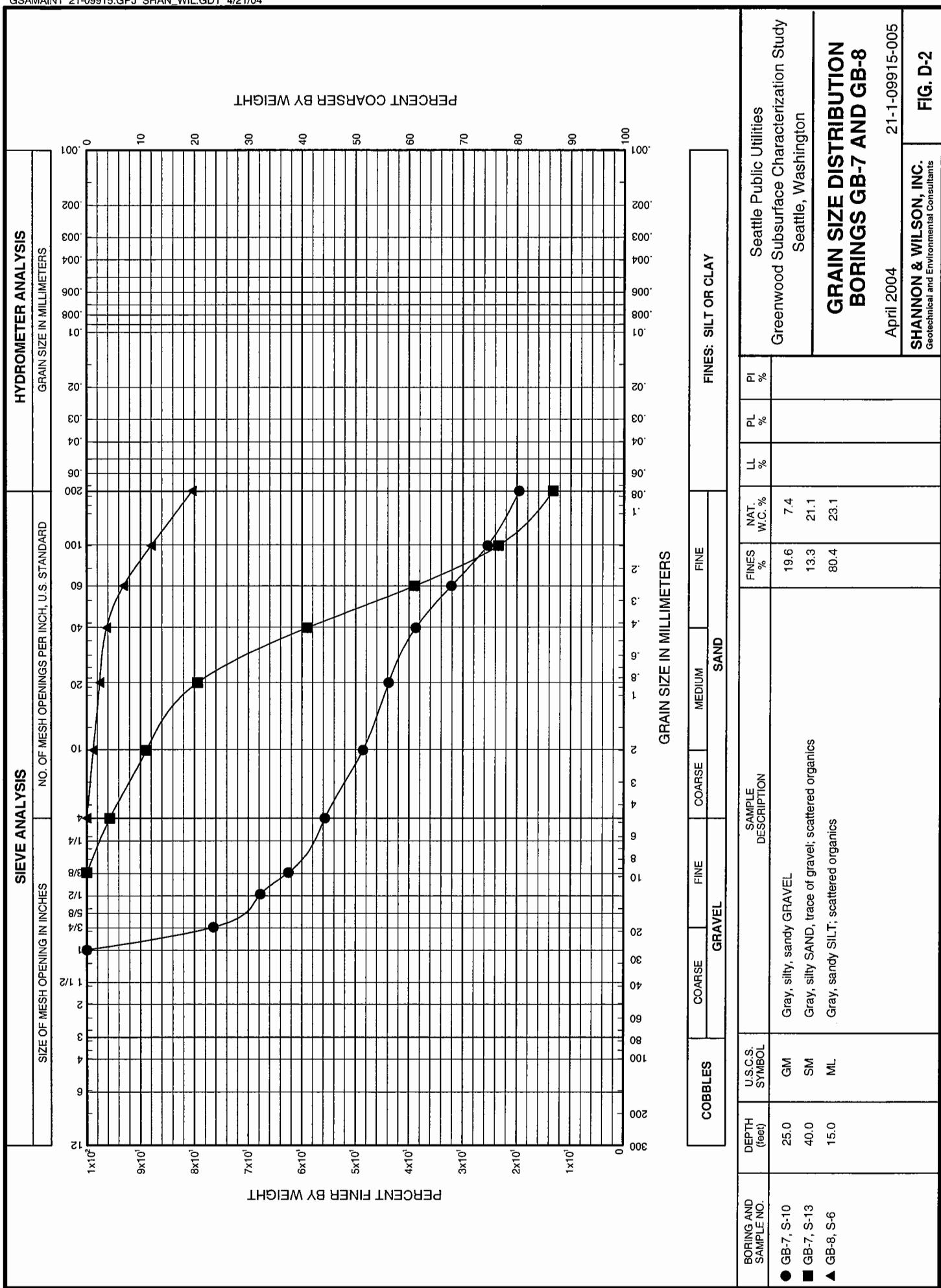


FIG. D-2

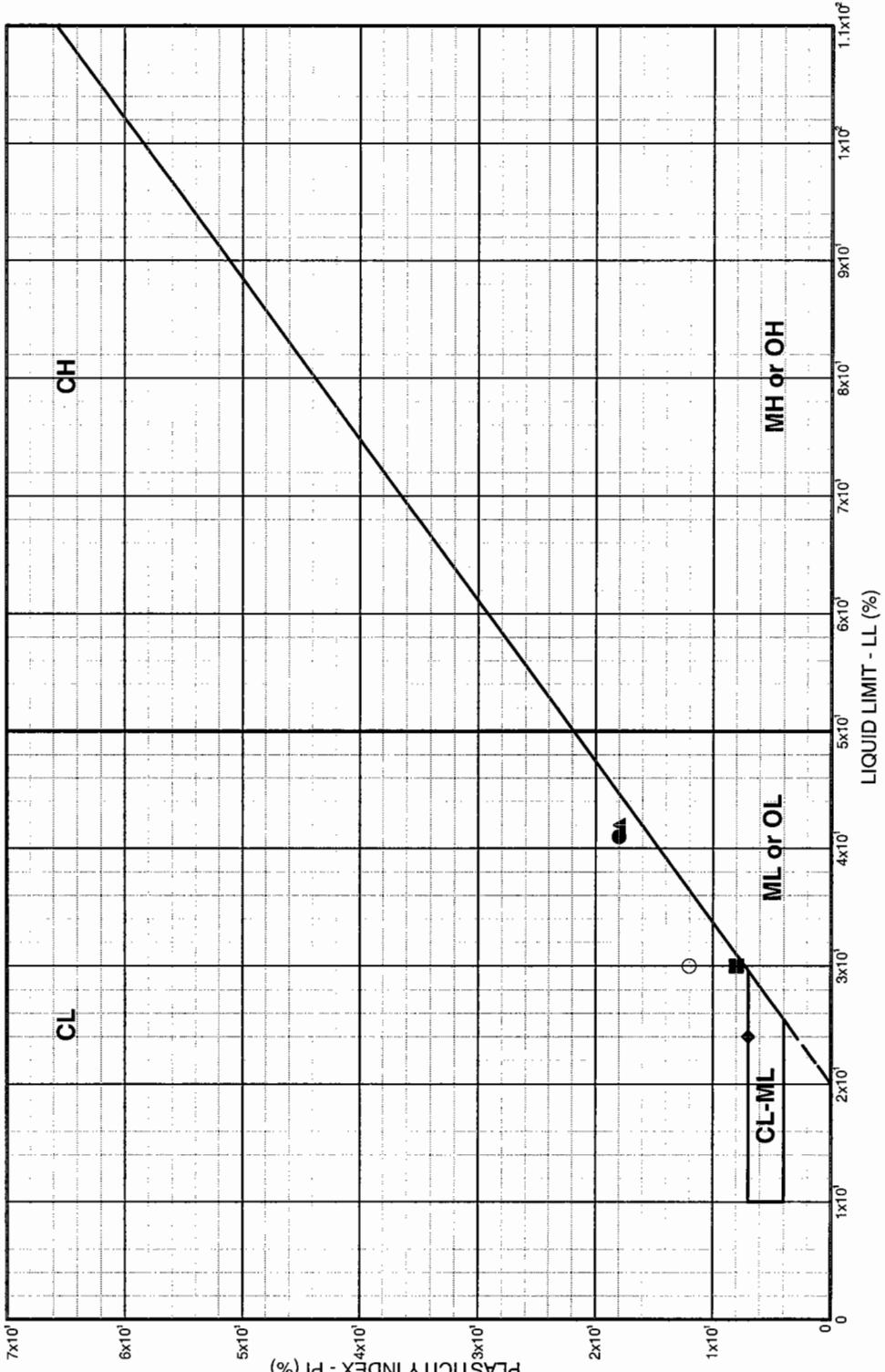
LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

CL-ML: Silty clays and clayey silts



Seattle Public Utilities Greenwood Subsurface Characterization Study Seattle, Washington									
PLASTICITY CHART									
April 2004									
BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PI %	NAT. W.C. %	PASS. #200, %		
● GB-2, S-5	12.5	CL	Gray, silty CLAY, trace of fine sand	41	23	18	67.2		
■ GB-2, S-6	15.0	CL	Gray, silty CLAY	30	22	8	45.7		
▲ GB-3, S-6	15.0	CL	Gray, silty CLAY	42	24	18	43.7		
◆ GB-6, S-6	15.0	CL-ML	Gray, silty CLAY, trace of sand and gravel; scattered organics	24	17	7	14.6		
○ GB-8, S-2	5.5	CL	Gray, silty CLAY, trace of sand ; numerous organics	30	18	12	30.6		

FIG. D-3